NIMBUS AND RIEDEREN MAKE CONTACT

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The Photos Transmitted by the American Satellite are Perfectly Received by the Swiss Station

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ABSTRACT

The article discusses some technical characteristics of the new Nimbus I weather satellite and compares its operation with that of the Tiros series, emphasizing recent improvements in photographing techniques. The construction of the Riederen receiving station near Berne is examined, and the physical makeup and importance of equipment are considered.

An evaluation is made of the importance of the station both to Switzerland and in terms of a world-wide meteorological system, both now and for the future.

Launched successfully from Vandenberg (California) Air Base last August 29, Nimbus I, the heaviest and most complex of the American weather satellites, stopped functioning on September 23 after 27 days of remarkable work during

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* Numbers given in the margin indicate the pagination in the original foreign text.

which it made 83 revolutions around the Earth, sent 27,000 excellent photos to American meteorologists... and allowed Switzerland its first real space experience.

How? That is what we would like to tell here. But first, some technical data are necessary.

Nimbus, a project of the Office of Space Sciences and Applications, built by Goddard Space Flight Center Greenbelt Maryland, is a 375 kg 500 engine which presents, in comparison with the Tiros weather satellites, its predecessors built by RCA, the advantage of having its cameras constantly aimed at the Earth. The Tiros are actually stabilized in space and thus remain permanently aimed in the same direction. Therefore they sometimes photograph empty space. The stabilization system in Nimbus avoids the disadvantage.

Nimbus I was initially to have been placed into a circular, almost polar, orbit 950 km in altitude. However, due probably to the too rapid dying of the second stage of the Thor Agena lifting rocket, the orbit obtained was elliptic, with a perigee of 419 km and an apogee of 950. After several hours of worry, it was found that the photos received were excellent, even if the fact of an elliptical orbit doomed the satellite to a shorter life.

A night bird that sees quite well during the day!

Three photo-taking systems were installed on board:

- an infrared camera which permitted taking photos even at night, an advantage used for the first time on a weather satellite. /7

- a combination of three cameras to operate during the day (for the first two systems the pictures taken were stored on magnetic tape on the satellite and

sent, on command, to the American stations at Gilmore Creek, Alaska and Rosman, North Carolina when the engine passed over them).

- an APT (Automatic Picture Transmission) apparatus which allowed meteorological stations spread around the world, and belonging to twelve countries, to receive directly photos taken by Nimbus at the moment it flew over them.

From the producer to the consumer.

The APT system, which has already been used by the satellite Tiros VIII, operates on the following principal:

Each photo taken by the APT camera is immediately and automatically transmitted to Earth by a transmitter in the satellite (it is not stored). In this manner if a station equipped to receive the transmission is located in the area /14 being flown over, it can receive the photo. This is therefore an ingenious instrument, both advantageous and witness to a good spirit of international cooperation. It allows instant reception of the cloud physiognomy of a complete area, each view covering a zone 1600 km in width (when the satellite is 900 km in altitude). Pilots and meteorologists can therefore gain several advantages. Beyond this, it prefigures the world-wide meteorological system toward which we are gradually working.

The Swiss station, built in record time.

This is why Swiss initiative to build an APT reception station, aside from the fact that it offered a concrete effort for space research, reveals a particular importance for all our country.

In fact, the idea of a reception station for data furnished by satellites goes back several years. But the first project did not manage to see the light of day. Also, since NASA (the American Aeronautics and Space Administration)

offered the possibility to interested countries of constructing receiving stations for photos taken by its weather satellites, Switzerland decided to send the physicist Mr. Rieker, an expert from the space research commision, to the United States.

Following this trip, the commission's conclusions being favorable to the enterprise, it was decided to begin work on the described station. The year 1963 was already quite well advanced and still there was everything to be done, from theoretical studies to choice of materials. Radio-Suisse conferred this heavy responsibility to the engineer Mr. François Grandchamp, assistant to the chief engineer. In less than a year, Mr. Grandchamp who was doing pioneering work in this field in Switzerland, started a remarkable receiving center, and from the beginning of September of this year he has been receiving photos of excellent quality. The success had been made possible especially through the valuable aid of a restrained but enthusiastic team composed of Mr. Fuchs and Mr. Bühlmann, radio technicians, and Mr. Tiaget and Mr. Rieker, physicists from the Swiss Institute of Meteorology (ISM), which assured the meteorological exploitation of data received.

The meteorologists dominate the situation.

The station, placed at Riederen, near Berne, in one of the most important telecommunications centers of Radio-Suisse, is composed of an exterior antenna which can "follow" the satellite while it crosses the Berne sky, and equipment permitting on one hand recording on magnetic tape the signals received, and on the other translating them simultaneously into photos. We notice, by the way, that the magnetic tape permits "remaking" a photo on request. The radio ensemble, like the antenna, is Swiss made.

The satellite, taking and transmitting an APT photo in 208 seconds, was "visible" (in the radio sense of the word, of course) every day during the three successive passes in the middle of the morning. The meteorologists could thus make daily use of a very nice "cover" of the European sky, seen in an ununual manner, from above, while until now they had been accustomed to observing it only from below!

"Still, said Mr. François Grandchamp, it is only a beginning." A beginning, of course, since it is only a matter of an experimental station, but a promising beginning. Besides, although Nimbus I is no longer emitting, Riederen station is not relegated to idleness; Tiros VIII, also equipped with the APT system, can furnish some important photos. However, there is something even better: plans are already drawn up for a permanent station also of complete Swiss construction. The antenna will be radio controlled from a control board, located in a receiving building, on which will be laid out all the radio regulation instruments. Signals received will be retransmitted as well instantaneously by telephone to principal Swiss airports and to ISM, which will have the apparatus necessary to transform them into photos.

Also, without wanting to attempt to forecast the future, we can imagine that, thanks to this construction, our country will doubtlessly be able to play an active role in the creation of a world-wide system of meteorology through satellites.

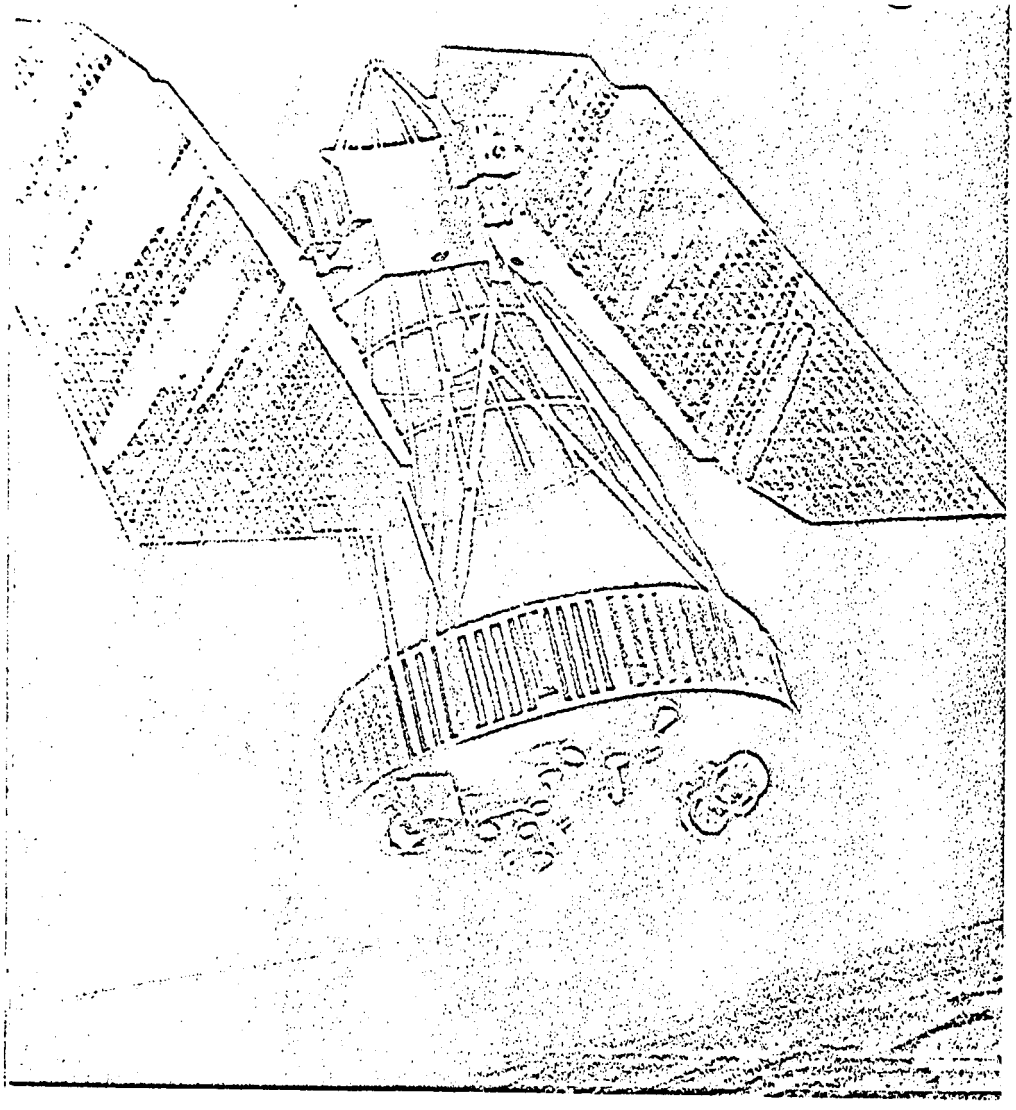

Figure 1. The Nimbus I satellite. The cameras are noticeable at the base. On each side of its structure are movable panels covered with solar cells which furnish power to the various cameras on board. These panels are mobile and are automatically oriented toward the sun. By locking they caused the stopping of emissions from Nimbus on September 23.

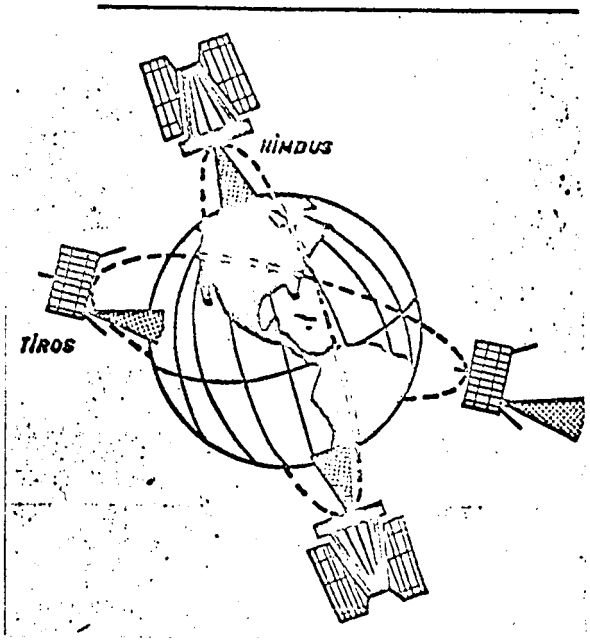

Figure 2. This diagram shows the orbits described by Tiros and Nimbus. It can be seen how Tiros, stablized in respect to one direction in space, sometimes photographs "in space". Nimbus, on the contrary, always has its cameras aimed toward the Earth.

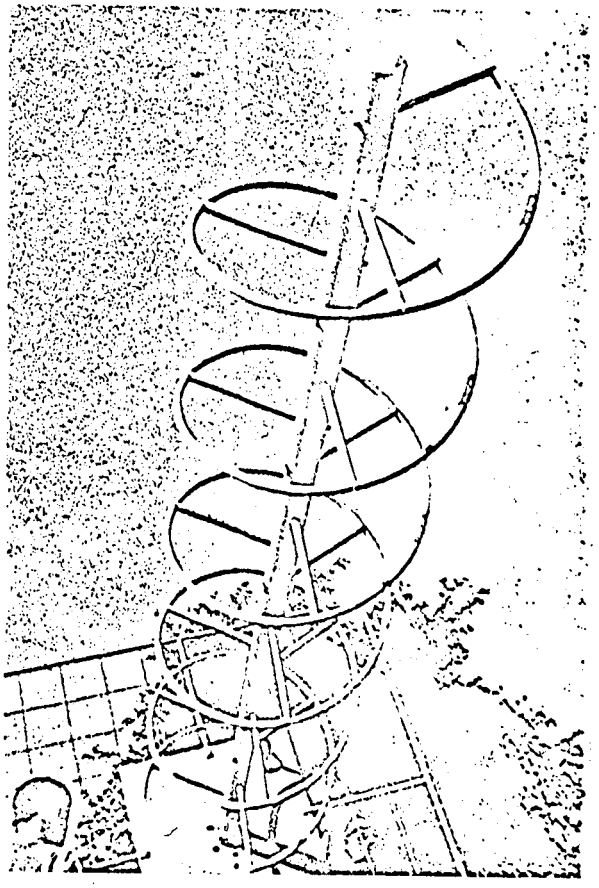

Figure 3. The antenna from the station built by Radio-Suisse "follows" the satellite during its passage in the sky over Berne.

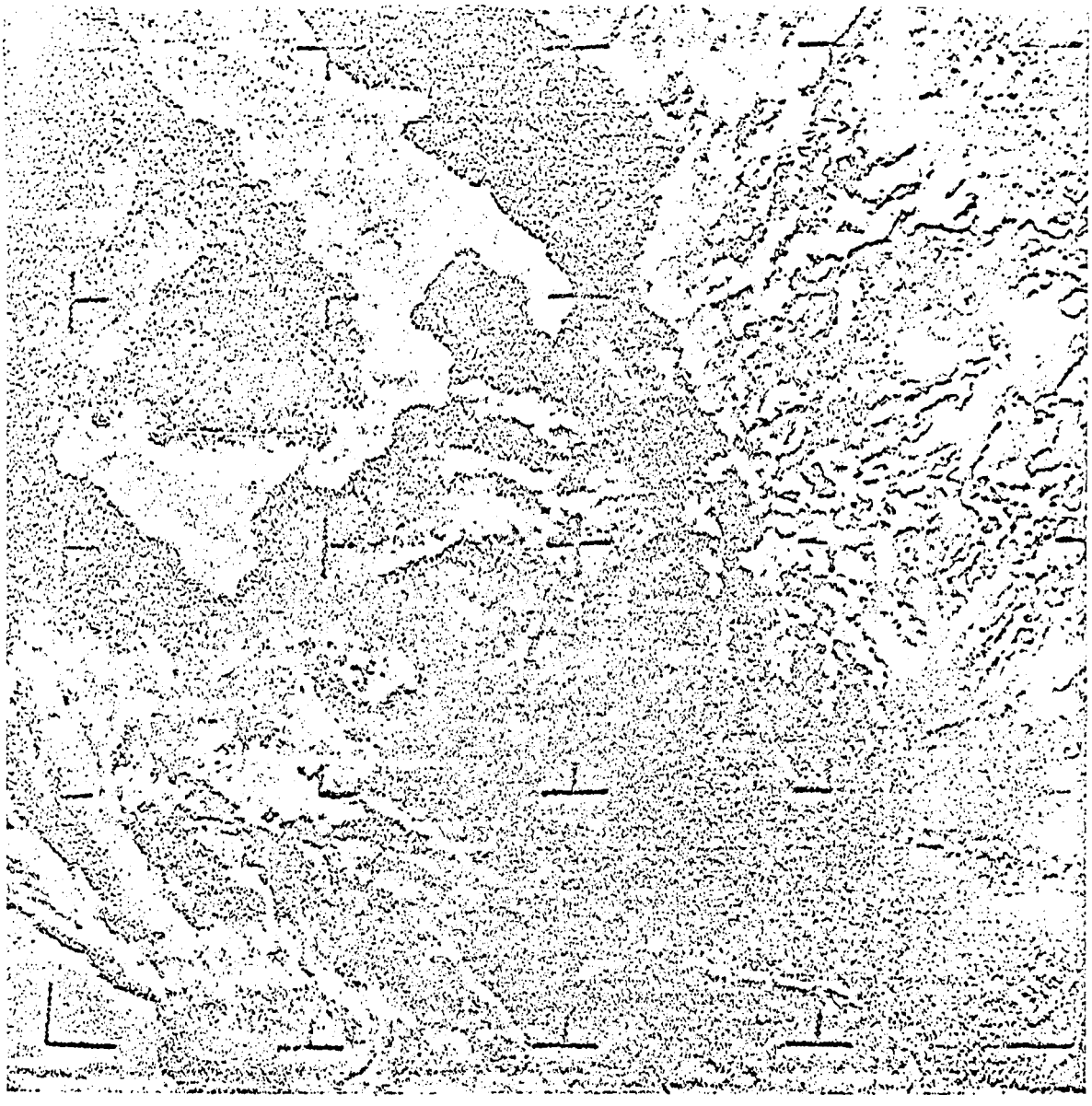

Figure 4. Photo received at Riederen station. On the left part of the photo Sicily and the Italian boot are clearly visible, and on the right side Yugoslavia, Albania and Greece, covered by clouds. Below and to the right, the island of Crete.

Figure 5. In Riederen station's receiving area, Mr. Fuchs (at center) and Mr. Piaget (on the right) look over the radio sets during a pass by Nimbus.

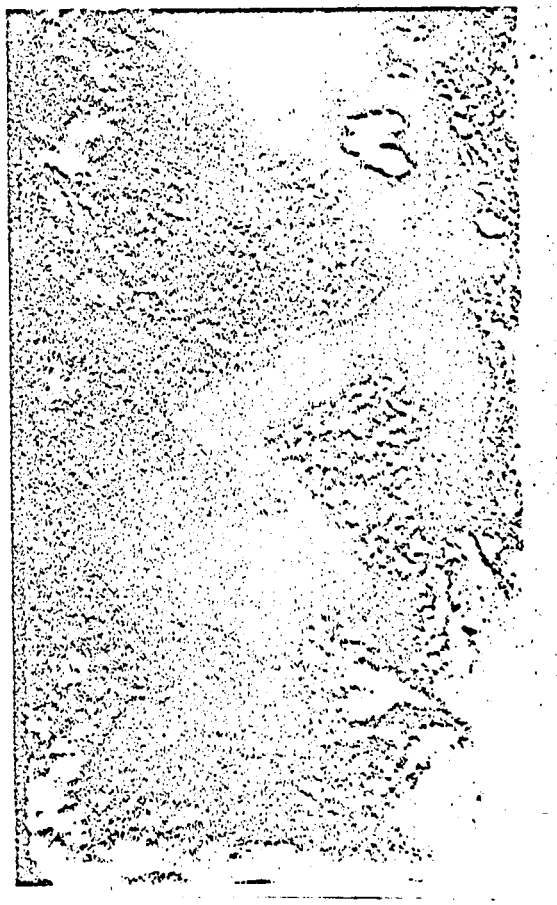

Figure 6. Photo taken late at night by Nimbus, through use of its infrared camera, and rètransmitted to the American ground stations. It shows the Southeast coast of Mozambique (in the center), from the West coast of Madagascar (at right) and from the coast of South Africa (lower left). Lake Nyassa is clearly visible in the upper left.